Title: Portable microprocessor-assisted data medium which can be operated both in contacted and contactless fashion

Background of the Invention

The invention relates to a portable microprocessor-assisted data medium which can be operated both in contacted and contactless fashion. In this context the portable data medium is preferably in the form of a smart card.

Contacted cards have electrical contact surfaces for the supply of power and for data interchange with a corresponding data input/data output unit operating in contacted fashion when in physical contact. Contacted cards have been widespread for a relatively long time as access authorization cards for GSM mobile radio systems, telephone cards, health insurance cards, bank cards etc.

Contactless cards contain a coil as an antenna for the supply of power and for data interchange with a corresponding data input/data output unit operating in contactless (inductive) fashion. In this context, the card is provided with an antenna interface which uses an AC voltage induced in the coil to produce a DC voltage for supplying voltage to the microprocessor. The antenna interface also serves as a signal converter

for the data which is to be interchanged between the contactlessly operating terminal and the microprocessor. The antenna interface is preferably integrated on a semiconductor module together with the microprocessor.

Brief Summary of the Invention

The subject of the invention is a portable microprocessor-assisted data medium which combines the two sets of functions (contacted and contactless) within itself. Such portable data media are known by the terms Combi card (combination of contacted and contactless functions) or Dual Interface Card (card with contacted and contactless interface).

The type of data transmission between the portable data medium and a data input/data output unit operating in contacted fashion is naturally different from the type of data transmission between the portable data medium and a data input/data output unit operating in contactless fashion. Different transmission protocols are used for the portable data medium's contacted mode and contactless mode. Indeed, different transmission protocols (T = 0, T = 1, T = 14) are known only for the contacted mode.

The portable data media which are the subject of the invention support both at least one transmission

protocol for the contacted mode (e.g. T = 1) and a transmission protocol for the contactless mode.

The portable data media forming the subject of the invention have an operating system which - irrespective of the type of data transmission - processes and administers the data stored in various memory areas on the basis of the commands received from the respective data input/data output unit.

In turn, one, two or more application programs can be installed on such an operating system. Such portable data media on which a plurality of application programs are installed are also called multifunctional smart cards. The portable data medium forming the subject of the invention would then be referred to as a multifunctional Dual Interface Card. In this context, each application can have various memory areas allocated to it. Thus, by way of example, the portable data medium could comprise a cash card application supervised by banks and a local public passenger services application supervised by a local public passenger services network operator. In this context, the cash card application would be allocated a cash fund as the memory area and the local public passenger services application would be allocated a corresponding

local public passenger services fund as the memory area.

Whereas a prerequisite for contacted use of the portable data medium is always that the holder of the portable data medium consciously and deliberately introduces it into the appropriate data input/data output unit, this conscious, deliberate behavior is not always necessary for data transmission to take place in the case of contactless operation. The sometimes relatively long range of contactlessly operating data input/data output units means that data transmission can also take place even when the portable data medium is still in the data medium holder's pocket, for example. Thus, for example, whenever the holder passes through the entrance and/or exit area of underground stations, contactless data transmission can automatically be set up for the purpose of quick and convenient fare payment.

However, this advantage of the contactless mode of operation presents a risk in a portable data medium which can be operated both in contactless and contacted fashion. This risk is that hackers could attempt to use a contactlessly operating data input/data output unit in order also to access, unnoticed, memory areas which are actually reserved for the contacted-mode

application, with access to this memory area normally having the prerequisite that the data medium is consciously and deliberately introduced into the data input/data output unit operating in contacted fashion.

The object of the invention is therefore to provide a portable microprocessor-assisted data medium which can be operated both in contacted and contactless fashion and is provided with the assurance that it is not possible for memory areas which are intended to be reserved for the contacted-mode application to be contactlessly accessed without the data medium holder's knowledge.

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Brief Description of the Drawings

The invention achieves this object by virtue of the portable data medium storing at least one data transmission-specific access condition for at least one memory area, said access condition defining, on the basis of the type of data transmission between the portable data medium and a data input/data output unit, the condition under which access to this memory area is permitted.

The access condition may be an individual bit indicating, as a flag, whether or not access to this memory area is permitted for the current type of data transmission (contacted or contactless).

The procedure used according to the invention is that, before this memory area is accessed, i.e. before a command transmitted by the data input/data output unit is executed, the portable data medium itself uses a checking program stored in the portable data medium to read the data transmission-specific access condition associated with this memory area. It then checks whether, in consideration of the access condition, the desired access command is permitted in the case of the particular current type of data transmission. The corresponding access command is then executed only if the result of the check is that this access is permitted. In this context, the portable data medium stores a respective item of information about what the current data transmission type is, i.e. which transmission protocol is currently being used.

The inventive provision of a data transmission-specific access condition thus reliably ensures that access to particular memory areas is prohibited in the case of contactless data transmission, while access is permitted in the case of contacted data transmission.

In this context, access in the case of contactless data transmission is blocked generally in one embodiment.

In another embodiment, the access restriction applies only to particular access types (commands), while other access types are permitted. In this context, a single access condition may be provided which defines for various access types different conditions under which this access type is permitted. As an alternative to this, a dedicated data transmission-specific access condition is provided for each access type.

In addition, the reverse configuration is also within the scope of the invention, where, in the case of contacted operation, appropriate access conditions are used to block access to particular memory areas which are intended to be reserved only for the contactless mode.

Furthermore, provision is also made for at least one data transmission-specific access condition to be provided only for the contacted mode, said access condition defining, on the basis of the active contacted transmission protocol (T = 0, T = 1, T = 14), the condition under which access to a memory area is permitted.

In this context, the data transmission-specific access condition according to the invention can be input into a freely programmable nonvolatile memory in the

portable data medium by authorized agencies using an item of secret information, and the access conditions may preferably also be reprogramed. The access conditions are programed in so-called initialization and/or personalization steps.

Instead of freely programing the access conditions, they may also be stored in a nonmodifiable read only memory (ROM).

The appended drawings will be used to explain the invention in more detail below.

Figure 1 shows the portable data medium in the form of a smart card. For the contacted mode of operation, said smart card has electrically conductive contact surfaces (Ki) on one side of the card. For the contactless mode of operation, an antenna (A) in the form of a coil is situated in the card body. For illustrative purposes, the card body is shown open at two places in the region of the coil winding.

Figure 2 shows a schematic illustration of the portable data medium. It shows the semiconductor module containing a microprocessor, a memory and an integrated antenna interface. The antenna (A) is connected to one side of this one semiconductor module by means of

appropriate connecting lines (LA), and the contact surfaces (Ki) are connected to the other side of it by means of appropriate connecting lines (LKi). In addition to the CPU as the central arithmetic and logic unit, the semiconductor module contains a read only memory (ROM), which stores at least sections of the operating system, and a volatile main memory (RAM). In addition, there is a nonvolatile programmable memory (EEPROM) divided into various memory areas. This memory can store, amongst other things, a section of the operating system. Furthermore, it contains the application programs with appropriate memory areas as data fields.

Figure 3A is a schematic illustration of the portable data medium in conjunction with a data input/data output unit operating in contacted fashion; Figure 3B is a schematic illustration of the portable data medium in conjunction with a data input/data output unit operating in contactless fashion.

Figure 4 is a schematic exemplary illustration of various memory areas of the EEPROM memory with the appropriate access conditions according to the invention. In this context, the i-th memory area is provided as a data field for a cash fund which is used in connection with the contacted cash card application.

In addition, there is the j-th memory area, which is used as the data field for a further fund, which is used in connection with the contactless local public passenger services application. In this case, the "cash fund" memory area has 4 associated access conditions (AC1, AC2, AC3, AC4), which define access to this memory area on the basis of the contacted or contactless mode of operation. In the simplest case, the access conditions are stored as a flag in the form of a single bit which can be set or not set.

Thus, for example, the meanings are as follows:

AC1 = 1: Read command permitted in contacted mode,
AC1 = 0: Read command prohibited in contacted mode,
AC2 = 1: Update command permitted in contacted mode,
AC2 = 0: Update command prohibited in contacted mode,
AC3 = 1: Read command prohibited in contactless mode,
AC3 = 0: Read command permitted in contactless mode,
AC4 = 1: Update command prohibited in contactless mode,
AC2 = 0: Update command permitted in contactless mode.

The same applies to the access conditions for the local public passenger services fund.

The access conditions themselves can be read internally (in the portable data medium) in both modes of operation. Optionally, the access conditions can also be read by the data input/data output units. They may be changed only by authorized agencies, however.